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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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| Applicant: | Gregory E. Howard, et al. | Docket No: | TI-29894 |
| Serial No: | 09/967,187 | Conf. No: | 5978 |
| Examiner: | Ida M. Soward | Art Unit: | 2822 |
| Filed: | 09/28/2001 | | |
| For: | BIPOLAR JUNCTION TRANSISTOR | | |



9/Appeal Brief 12-20-02 Fuller

## APPEAL BRIEF UNDER 37 C.F.R. 1.192

MAILING CERTIFICATE UNDER 37 C.F.R. §1.8(A)
I hereby certify that this Appeal Brief filed, in triplicate, under 37 CFR 1.192 is being deposited with the U.S. Postal Service as First Class Mail in an envelope addressed to: Assistant Commissioner of Patents, Washington, DC 20231 on 12-10-02.

Ann Trent
Ann Trent

Assistant Commissioner of Patents
Washington, D. C. 20231

Dear Sir:

The following Appeal Brief is respectfully submitted in triplicate and in connection with the above identified application in response to the final rejection mailed July 15, 2002.

Real Party in Interest under 37 C.F.R. 1.192(c)(1)

Texas Instruments Incorporated is the real party in interest.

Related Appeals and Interferences under 37 C.F.R. 1.192 (c)(2)

There are no related appeals or interferences known to appellant, the appellant's legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the board's decision in the pending appeal.

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Status of Claims on Appeal under 37 C.F.R. 1.192 (c)(3)

Claims 1-9 are pending in this case. Claims 1-9 are appealed.

Status of Amendments Filed After Final rejection under 37 C.F.R. 1.192 (c)(4)

No amendments were filed after final rejection.

Summary of the Invention under 37 C.F.R. 1.192(c)(5)

The invention is a bipolar junction transistor with an improved collector region that maximizes both Bvceo and Ft/Fmax for optimum performance.

Scattering centers are introduced in the collector region of the bipolar junction tansistor to improve Bveco. The inclusion of the scattering centers allows the width of the collector region $W_{CD}$ to be reduced leading to an improvement in Ft/Fmax.

Statement of Issues Presented for Review under 37 C.F.R. 1.192 (C)(6)

1. Is claim 1 properly rejected under 35 U.S.C. 102(b) as being anticipated by the Momose patent (US 5,198,692)?

2. Are claims 2, 4-6 and 8 properly rejected under 35 U.S.C. 103(a) as being unpatentable over the Momose patent (US 5, 198,692) in view of the Kabir et al. patent (US 6,346,452 B1)?

3. Are claims 3 and 7 properly rejected under 35 U.S.C. 103(a) as being unpatentable over the Momose patent (US 5, 198,692) in view of the Kabir et al. patent (US 6,346,452 B1) as applied to claims 1 and 5 above, and further in view of Prior Art Figure 1?

Statement of the Grouping of Claims under 37 C.F.R. 1.192(C)(7)

Claims 1-9 stand or fall together.

Arguments

1. Is claim 1 properly rejected under 35 U.S.C. 102(b) as being anticipated by the Momose patent (US 5,198,692)?

Patent owner respectfully submits that claim 1 is not properly rejected under 35 U.S.C. 102(b) as being anticipated by the Momose patent.

Claim 1 of the instant invention has the limitation of a counterdoped collector region adjacent to the buried collector region. For a 102(b) rejection to be valid each and every element of the claim must be contained in the cited art. The examiner states that the Momose patent teaches a counterdoped collector region 3. In fact the Momose patent teaches an n-type epitaxial collector region (col. 2, line 66 to col. 3, line 1). The epitaxial layer is grown using $SiH_2Cl_2$ and made n-type. The term counterdoped as described in the specification of the instant disclosure and used in claim 1 describes a collector region in a certain specified state. The following example will make this clear. Consider a collector with n-type doping of $2 \times 10^{17} cm^{-3}$. In the case of the Momose patent this could be achieved by doping the collector region with $2 \times 10^{17} cm^{-3}$ atoms of phosphorous. In the case of a counter doped collector region let us suppose that the collector is initially doped p-type with $0.5 \times 10^{17} cm^{-3}$ of boron atoms. To achieve a net n-type doping concentration of $2 \times 10^{17} cm^{-3}$, $2.5 \times 10^{17} cm^{-3}$ of phosphorous atoms would have to be added. The overall physical state of the counterdoped collector region is therefore completely different when compared to the non-counterdoped region. For example the additional boron atoms introduces additional scattering centers in the collector region. The element of a counterdoped collector region is not found in the Momose patent and therefore claim 1cannot be properly rejected under 35 U.S.C. 102(b) as being anticipated by the Momose patent.

2. Are claims 2, 4-6 and 8 properly rejected under 35 U.S.C. 103(a) as being unpatentable over the Momose patent (US 5, 198,692) in view of the Kabir et al. patent (US 6,346,452 B1)?

Patent owner respectfully submits that claims 2, 4-6 and 8 are not properly rejected under 35 U.S.C. 103(a) as being unpatentable over the Momose patent (US 5, 198,692) in view of the Kabir et al. patent (US 6,346,452 B1).

Claims 2 and 4 depend from claim 1 and so contain all the limitations of claim 1 including that of requiring a counterdoped collector. The Momose patent does not describe a counterdoped collector region. The Kabir et al. patent does not teach or describe a counterdoped collector region. In fact the Kabir et al. teaches away from a counter doped collector region by describing the formation of an undoped epitaxial region 306. Since nether the Momose patent nor the Kabir et al. patent describe or teach a counterdoped collector region then claims 2 and 4 are allowable over the cited art.

Independent claim 5 contains the limitation of a collector region containing at least $0.5 \times 10^{17} cm^{-3}$ scattering centers. The examiner refers to the Kabir et al. patent has having taught or described neutral phosphorous scattering centers (cols. 2-3, lines 66-67 and 1-42 respectively). Applicant is not sure what is meant by neutral scattering centers since the normal state for phosphorous in the silicon lattice is that of a charged ionized donor. In addition the applicant cannot find a reference for a neutral scattering center in the referred to section of the cited art. Since the requirement for at least $0.5 \times 10^{17}$ $cm^{-3}$ scattering centers is not found in either the Momose patent or the Kabir et al. patent then claim 5 is allowable over the cited art.

Claims 6 and 8 depend from claim 5 and contain the limitations of claim 5. As such claims 6 and 8 are allowable over the Momose patent and the Kabir et al. patent for the reasons stated above.

3. Are claims 3 and 7 properly rejected under 35 U.S.C. 103(a) as being unpatentable over the Momose patent (US 5, 198,692) in view of the Kabir et al. patent (US 6,346,452 B1) as applied to claims 1 and 5 above, and further in view of Prior Art Figure 1?

Patent owner respectfully submits that claims 3 and 7 are not properly rejected under 35 U.S.C. 103(a) as being unpatentable over the Momose patent (US 5, 198,692) in view of the Kabir et al. patent (US 6,346,452 B1) as applied to claims 1 and 5 above, and further in view of Prior Art Figure 1?

As described above claims 1 and 5 are allowable over the cited art. Claim 3 depends from claim 1 and contains the limitation of a counterdoped base region. The counterdoped base region in not taught in either the Momose patent, the Kabir et al. patent, or Prior Art Figure 1. As such claim 3 is allowable over the cited art for the reasons cited above.

Claim 7 depends from claim 5 and contains the limitation of at least $0.5 \times 10^{17}$ $cm^{-3}$ scattering centers. As discussed above this requirement in not taught in either the Momose patent, the Kabir et al. patent, or Prior Art Figure 1. As such claim 7 is allowable over the cited art for the reasons cited above.

Conclusion

For the foregoing reasons, Appellants respectfully submit that the Examiner's final rejection of Claims 1-9 under 35 U.S.C. §§ 102 and 103 is not properly founded in law, and it is respectfully requested that the Board of Patent Appeals and Interferences so find and reverse the Examiner's rejections.

To the extent necessary, the Appellants petition for an Extension of Time under 37 CFR 1.136. Please charge any fees in connection with the filing of this paper,

including extension of time fees, to the deposit account of Texas Instruments Incorporated, Account No. 20-0668. **This form is submitted in triplicate.**

Respectfully submitted,

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APPENDIX

Claims on Appeal

1. A bipolar junction transistor, comprising:

a buried collector layer;

a counterdoped collector region adjacent to said buried collector layer;

a base region adjacent to said counterdoped collector region; and

an emitter region adjacent to said base region.

2. The bipolar junction transistor of claim 1 wherein at least one of the dopant species in said counterdoped collector region has a dopant concentration of greater than $0.5x10^{17}cm^{-3}$.

3. The bipolar junction transistor of claim 1 wherein the distance from the edge of said buried collector layer which is adjacent to said collector region to the edge of said base region which is adjacent to said collector region is less than 1500 angstroms.

4. The bipolar junction transistor of claim 1 wherein the base region is silicon germanium.

5. A bipolar junction transistor, comprising:

a buried collector layer;

a collector region adjacent to said buried collector layer wherein said collector region contains at least $0.5x10^{17}cm^{-3}$ scattering centers;

a base region adjacent to said collector region; and

an emitter region adjacent to said base region.

6. The bipolar junction transistor of claim 5 wherein said scattering centers are a species selected from the group consisting of boron, aluminum, gallium, indium, carbon, phosphorous, arsenic and antimony.

7. The bipolar junction transistor of claim 5 wherein the distance from the edge of said buried collector layer which is adjacent to said collector region to the edge of said base region which is adjacent to said collector region is less than 1500 angstroms.

8. The bipolar junction transistor of claim 5 wherein the base region is silicon germanium.

9. The bipolar junction transistor of claim 5 wherein the scattering centers of said collector region are neutral scattering centers.